



Ag Methane Advisors

Carbon Markets Update: Project Examples, Costs, Returns, Lessons learned

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Introduction

- **About Ag Methane Advisors, LLC**
- **Real, un-sugar coated perspective**
- **Voluntary vs. Compliance Markets**
- **The process of bringing offsets to market:**
 - » Project examples-dairy and swine
 - » Costs, returns, timing
 - » Project monitoring and verification
- **Lessons learned**
 - » Monitoring and biogas flow meter calibration
 - » Risks and rewards





About Ag Methane Advisors

- **Niche consultant specializing in Ag greenhouse gas accounting and monetization**
- **Goal: Provide the highest quality farmer focused services at the lowest cost**
- **7 years experience in livestock AD carbon offsets**
 - » >18 projects across the US
- **Life cycle assessment (e.g. Renewable fuels RIN markets)**
- **Background in production agriculture**



The Opportunity

- **Climate Action Reserve-domestic, highly respected Carbon Registry.**
- **Reserve's Livestock Protocol adopted by California Air Resources Board as Compliance Protocol**
- **Voluntary/Pre-Compliance Market, 2009-2012**
 - » Virtually all livestock AD projects in the U.S. have migrated over the past several years.
- **Compliance Market, 2013-2020**
 - » Early Action, 2006-2014
 - » Might be the only viable carbon market opportunity that currently exists for offsets of this type in the U.S.



The Opportunity (Cont.)

- Above what threshold is it economically viable to bring offsets to market (aka register offsets)?
- Monitoring equipment – Biogas flow meter for each combustion device, flare thermocouples, telemetry system
- Verification/Registration fees
- Environmental accounting, Project Development, brokerage, etc.
- Offset sales in about 15-18 months
- What is the return?



Project Examples-Hypothetical but realistic

- **Large Dairy-1900 Mature Cows (milking and dry)**
- **Very Large Dairy-4000 Mature Cows (milking and dry)**
- **Very Large Swine-18,000 Grow/Finish**
- **All three examples assume**
 - » Anaerobic digester (not covered lagoon) in Indiana in 2012
 - » 100% of manure managed in lagoon in baseline scenario and to digester
 - » ~53-58% CH₄ concentration
 - » Mature Cows ~1500 lbs, Feeder pigs average ~150 lbs
 - » No scraping of lagoon sludge during annual clean-out



Projected Annual Carbon Offset Volumes

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Farm	Large Dairy	Swine	Very Large Dairy
Livestock Population	1,900	18,000	4,000
Volume (mt CO ₂ eq)	10,223	10,000	22,754

- **More Livestock = More Manure = More Offsets**
- **Default assumptions (CAR Livestock Protocol/Calc Tool)**
 - » Volatile Solids Production
 - » Bo (m³ CH₄/Kg VS)
- **Global Warming Potential CH₄ = 21**



Indicative Compliance Market Prices (CCO8)

Year	'13	'14	'15	'16	'17	'18	'19	'20
Conservative Price	\$8.75	\$9.25	\$11	\$11	\$11	\$14	\$14	\$14
Optimistic Price	\$10	\$11	\$15	\$15	\$15	\$20	\$20	\$20

- **Voluntary Market 2009-2012**
 - » Livestock AD \$7-\$9
- **Carbon markets are dynamic (aka risky)**
 - » Value of a floor price
- **Buyer perception-uncertainty with Livestock AD delivery**
- **Share the upside when market value increases?**



Costs of Compliance

- **Above what threshold is it economically viable to register offsets?**
- **Monitoring equipment on each farm**
- **Offset sales in about 15-18 months**





Upfront Capital Costs

	Large Dairy	Swine	Very Large Dairy
Biogas flow meters, flare thermocouples, data logging system	\$16,000	\$16,000	\$20,00
Portable methane concentration analyzer	\$2,500	\$2,500	\$2,500
CAR initial project submittal fee	\$700	\$700	\$700
Total Capital Costs	\$19,200	\$19,200	\$23,200

- **Assumes monitoring equipment would not be purchased otherwise**
- **Large Dairy and Swine includes flow meters for 1 engine, 1 boiler and 1 flare**
 - » Very Large Dairy assumes a second engine
- **Continuous Biogas Analyzer?**



Annual Operating Costs



	Each Project	Large Dairy	Swine	Very Large Dairy
Data Collection/Farm Staff	??			
Offset Accounting/Project Development	10-40%??			
Monitoring Equip Maint. and Calibration	\$2-4K	\$2,000	\$2,000	\$4,000
Verification	\$12-20K	\$15,000	\$15,000	\$15,000
Registration	\$.23/offset	\$2,556	\$2,500	\$5,689
Brokerage	~\$.25/offset	\$2,556	\$2,500	\$5,689
Sub-Total Annual Operating Cost		\$22,112	\$22,000	\$30,377

- **Mostly fixed costs, not dependent on size of project**
- **Verification (full vs. desk review)**
- **Verification frequency options (12-24 months)**
- **Offset accounting/project development business models**

Projected 2013 Returns



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	Large Dairy	Swine	Very Large Dairy
Volume (mtCO2e)	10,223	10,000	22,754
Price (CCO8)	\$9.25	\$9.25	\$9.25
Gross Revenue	\$94,567	\$92,500	\$210,478
Amortized Capital Costs (10 years)	\$1,920	\$1,920	\$2,320
Operating Costs	\$22,112	\$22,000	\$30,377
Net Revenue	\$70,535	\$68,580	\$177,781

- **24 month verification option < 25K mtCO2e**
- **Inclusive of monitoring, verification, registration and brokerage costs (capital and operating)**
- **Exclusive of Offset Accounting/Project Development**
- **10 year crediting period, renewable once.**
 - » 8 years of CA Compliance Market

Lessons Learned

- **Carbon Market is Dynamic and Risky**
 - » No promise of easy returns
 - » Market risks, program (regulatory/political) risks
- **For dairy farms around 1,500 to 2,000 head and swine <15,000 head producing < 10K offsets per year... enough incentive?**
 - » Yes for unique situations
- **For larger farms (producing \geq 10K offsets per year)... clear incentive and financial benefit...still small compared to energy revenue.**
- **Bundle 24-36 months in one verification**



Lessons Learned (cont.)

- **Project Monitoring**

- » Biogas flow data is the crux! Diligence is key!
- » Farm staff capability to perform field calibration checks
 - » Quarterly
- » Flare monitoring and functional thermocouples
- » Lightning-plastic bushings
- » Log serial numbers of meters
- » Spare meters
- » Value of detailed operations logs
- » Conservative Variances, working with the Reserve
- » Don't scrape sludge out of lagoon if possible when spreading



Lessons Learned (cont.)

- **Risk Management**
 - » Trade-off: risk vs. value
 - » Voluntary and compliance demand
 - » Price floor
 - » 2-3 year contract vs. longer...
- **Issued vs Unit Contingent (UC)**
 - » Program risk vs market risk
 - » Ideal would see UC price floor with upside potential for 3-5 year contract.
- **Aggregate projects...**
 - » Achieves some efficiencies, co-marketing, enough volume to attract larger buyers





Thank you! Questions?



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